CHAPTER 6
DECOMMISSIONING PLANS

6-1. Types of plans

A preliminary decommissioning plan document is recommended for all nuclear facilities and required by the NRC for power reactors. A final decommissioning plan is required for all nuclear facilities. The initial version of the preliminary plan should be prepared in conjunction with the design of a facility. This plan will establish feasible decommissioning schemes that can be accomplished without undue risk to the health and safety of the public and decommissioning personnel, without adverse effects on the environment, and within established guides and limits of the appropriate regulatory agencies. While not a detailed document, this preliminary plan will serve to ensure that the decommissioning and ultimate disposition of a facility are considered during the initial design and construction of that facility. The preliminary plan will remain a "living document," and revisions will be made throughout the operating life of a facility. It must be reviewed periodically and revised to reflect any changes in facility construction or operation that might affect decommissioning. Prior to the initiation of actual decommissioning activities for a facility, a detailed final disposition plan is required. The final plan should be based on the preliminary plan and revisions, and will define specific work activities and include safety evaluations of planned decommissioning methods, new technology, and the facility status that will result from the decommissioning program. In addition, this plan must contain sufficient information to obtain any approvals needed from the appropriate regulatory agencies to proceed with decommissioning activities. The level of detail presented in a decommissioning plan will correspond to the complexity of the facility, type of source, potential for contamination, and perceived difficulty to perform the future decommissioning.

6-2. Preliminary plan

a. Plan Purpose. The preliminary plan serves to establish decommissioning as an important consideration from the inception of the project, during design and throughout the operation of the facility. The plan has the following purposes:

(1) The primary purpose of the preliminary plan is to ensure that facility designers are cognizant of decommissioning during the initial design of a facility. Thus, where design choices that would enhance decommissioning are available for types of materials and system components, and location of components, these choices should be made.

(2) Another purpose of the preliminary plan is to identity the ultimate decommissioning options and final facility status. Options should identity either the immediate, complete removal of all radioactive materials to permit unrestricted use of the facility or the deferred decommissioning approach of portions or all of the facility. These options would be evaluated and narrowed to the decommissioning method of choice as the end of facility life is approached.

(3) The final purpose of the preliminary plan is to demonstrate to regulatory agencies that important aspects of decommissioning are considered as early as possible during the initial design of a facility. The plan serves as the starting point to demonstrate that areas such as decommissioning methods, costs, schedules, and operating impact on decommissioning will be reviewed and refined throughout the operating life of a facility.

b. Plan Content. The preliminary plan will provide a general description of decommissioning methods considered feasible for the facility, including the management of radioactive waste resulting from each method. The description should demonstrate that the methods considered are practical and that they protect the health and safety of the public and decommissioning personnel. Design personnel should study the proposed decommissioning methods and take steps to ensure that the design incorporates features that will facilitate decommissioning. Considerations include:

(1) Provisions for adequate material-handling equipment.

(2) Provisions for separation of, and remote maintenance of, highly radioactive components.

(3) Provisions for effective decontamination or sealing of surfaces that may become radioactively contaminated.

(4) Location and adequate size of doors to permit movement of materials and components.

(5) An estimate of manpower, materials, and costs anticipated to support each decommissioning method considered.

(6) A description of the anticipated final disposition and status of the facility and site.

(7) A discussion demonstrating that adequate financing will be programmed for decommissioning.

(8) An estimate of the type, amount, and location of significant radionuclides and radioactively contaminated materials within the facility at the end of its operating life.

(9) Identification of records that should be maintained during facility construction and operation which might facilitate decommissioning, including a set of "as built" drawings.

(10) Identification and quantification of each radionuclide naturally present in the air, soil, and surface- and groundwater on-site as well as in the immediate area

around the site before the facility is operated. Measurements shall be made of the ambient direct-radiation levels in the area around the site before nuclear materials are brought onto the site. Reference Chapter 2 for a discussion on-site surveys for the sampling and measurement of radiation.

c. Plan Updating. The preliminary plan will evolve throughout the life of the facility. The plan is initially developed during design of the facility. Updates to the plan shall changes in the facility, changes in operations, and new technology.

(1) There is no definitive guidance governing the frequency at which a preliminary decommissioning plan should be reviewed and updated. The size of the facility, the activities which occur at a facility, the quantities of radioactive materials present, and the frequency of facility modification are examples of considerations that would affect the review frequency. For a large facility conducting a variety of activities involving large quantities of radioactive materials, a review frequency of every 2 to 3 years would be in order. For a facility where radioactive materials are only stored, a review frequency of every 5 or 6 years might be adequate. The plan-review frequency for other facilities would fall somewhere between these example frequencies.

(2) A review schedule and milestones for updating the decommissioning plan must be established in the preliminary plan and not be left undetermined. This schedule can be modified during the lifetime of the facility.

(3) The 10 CFR 50.75(f) requires that each reactor licensee submit a preliminary decommissioning plan approximately five years prior to the projected end of the operation of the nuclear facility. For these facilities, this milestone must be added to the review schedule developed.

(4) In addition to the scheduled plan review for a facility, the preliminary plan must be reviewed and updated as necessary whenever activities occur that might affect decommissioning. Examples of such activities are the alteration or addition of structures, changes in components or operations, and the addition of activities at a facility.

(5) Each time the plan is updated, any new decommissioning techniques shall be considered for incorporation in the plan.

d. Records. As previously mentioned, an important aspect of a preliminary decommissioning plan is the maintenance of appropriate records. These records should cover not only design but also events during the operating life of a facility. The 10 CFR 50.73(g) requires the maintenance of records that are important to safe decommissioning. The NRC should be consulted for current applicable guidance for maintenance of records. Records for all types of facilities should include:

(1) Structure and component material specifications.

(2) Plant-design documents.

(3) Methods, procedures, and order of assembly and construction.

(4) "As-built" drawings.

(5) Photographs of areas and component locations.

(6) Relevant facility operational parameters and any abnormal incidents in facility operation that could affect decommissioning. This includes records of spills or any other unusual occurrences involving the spread of contamination in and around the facility equipment or site.

(7) Surveys of radiation levels, contamination levels, and airborne radioactivity levels, as well as locations that were contaminated during facility operations.

e. Models. For complex facilities, such as nuclear reactors and hot cells, a model of the facility should be considered. A physical model can prove to be a valuable tool during design, construction, operation, and decommissioning of a facility. A model should be built to scale and should be completed prior to facility operation. This permits accurate modeling by actual field measurements before radiation hazards are present (instead of relying on drawing measurements only) and thus ensures an "as built" model. A model can effectively serve the following functions:

(1) Demonstrate adequate cleanance and access for the installation and removal of system components and other equipment.

(2) Show effects of the installation of temporary shielding and staging.

(3) Demonstrate rigging techniques and the location of attachment points.

(4) Show the location of radiation hot spots.

(5) Show emergency equipment locations.

(6) Serve as a training tool for operating personnel and craftsmen during facility operation and decommissioning activities. A model should be revised as necessary during the operating life of a facility to reflect any structural or component alterations, additions, or deletions.

6-3. Final plan

a. Purpose. The primary purpose of the final decommissioning plan is to demonstrate that decommissioning can be accomplished, how it will be carried out, and that radiation exposure to the public both during and after decommissioning will be within ALARA limits.

b. Plan Content. The final plan should be based on the preliminary plan as revised during the operating life of the facility and should include:

(1) A description of the facility before and after decommissioning activities.

(2) A description of the techniques and procedures to be used.

(3) An estimate of the type and quantity of radioactive and nonradioactive wastes to be generated and the plans for treatment, transportation, disposal, and storage.

(4) A safety analysis that includes assessment of the probability and severity of accidents that might occur during and after decommissioning.

(5) An environmental assessment of the facility during and after decommissioning. A dose assessment must be performed which demonstrates that the total radiation exposure from all pathways is within acceptable limits.

(6) An estimate of costs and identification of funding.

(7) Identification of organizations participating, including key staff and the responsibilities of each.

(8) An estimate of occupational and public radiation exposures resulting from decommissioning.

(9) Details on how the radiation protection program will function and how occupational and public radiation exposures will be maintained within regulatory and ALARA limits.

(10) Bases, criteria, and derived values for radioactivity levels that are acceptable for the release of facilities and materials for unrestricted use.

(11) A description of the quality control program.

(12) A description of the security program.

(13) Plans to respond to emergencies or unexpected occurrences.

(14) Records and reports to be generated during decommissioning, and the disposition of such documents.

(15) A description of the environmental monitoring, surveillance, and maintenance program that will be implemented during decommissioning.

(16) A description of the final radiation survey to release the facility for unrestricted use.

c. Plan Outline. In August 1989, the NRC issued Regulatory Guide 3.65, "Standard Format and Content of Decommissioning Plans for Licenses Under 10CFR Parts 30,40, and 70." This Regulatory Guide should be used by all nonreactor facilities in the preparation of their decommissioning plan. In addition to providing general information on format and provisions for revising the plan, it provides information on what the plan should contain. The NRC guidance is covered by 10 CFR 50. The general contents of the plan are summarized below:

(1) General Information.

(2) Description of Planned Decommissioning Activities.

(a) Decommissioning Objective, Activities, Tasks, and Schedules.

(b) Decommissioning Organization and Responsibilities.

(c) Training.

(d) Contractor Assistance.

(3) Description of Methods Used for Protection of Occupational and Public Health and Safety.

(a) Facility Radiological History Information.

(b) Ensuring that Occupational Radiation Exposures are ALARA.

(c) Health Physics Program.

(d) Contractor Personnel.

(e) Radioactive Waste Management.

(4) Planned Final Radiation Survey.

(5) Funding.

(6) Physical Security Plan and Material Control and Accounting Plan Provisions in Place During Decommissioning.

d. Submittal Schedule. The final plan should be completed at least one year prior to the end of facility operation or as required by the approval agency, even if there will be. a delay between the end of facility operation and the commencement of decommissioning activities. This period will serve two important functions: it will ensure that key facility personnel are still available to provide input to the plan, and it will given regulatory agencies lead time to review the plan for approval. If decommissioning is delayed using SAFSTOR or ENTOMB alternatives, then an additional submittal and update of the plan is necessary prior to the start of final decommissioning.

6-4. Approval agencies

Depending on the activities performed at a facility, approval for a final decommissioning plan will be needed from one or more agencies:

a. NRC. The NRC will be the approval agency, after DOD agency review, for decommissioning plans related to NRC licensed ionizing radiation sources.

b. DOD. If a facility has no radioactive materials licensed by the NRC but does have other sources of radiation, such as X-ray machines and radium, which are regulated by a DOD agency then this agency will be the approval agency for the decommissioning plan.

c. Joint Regulation. For a facility with a combination of radiation sources regulated by both the NRC and other agencies, approval of the decommissioning plan will fall within the jurisdiction of two or more agencies. In addition to DOD and NRC approval agencies, state approval agencies must be included, where required, during the plan development and approval process.

6-5. Control of deferred decommissioned facilities

The final plan must address security and maintenance of facilities which must remain in effect until decommissioning is complete. A nuclear facility that has been successfully decommissioned and released for unrestricted use requires no further control or maintenance with respect to protection against radiation. Deferred decommission of a facility or part of a facility (SAFSTOR or ENTOMB) results in non-operational buildings or other entities containing radioactive contamination in excess of limits permitting uncontrolled release of the facility. In addition, on-site storage (five years or less) of LLW on-site may be

considered necessary. The decommissioning plan must address restriction of unauthorized entry into such facilities and the maintenance of those facilities. Limited guidance on preparation of facilities for deferred decommissioning is presented below

a. Physical Security. The use of multiple locked barriers and intrusion alarm systems to prevent inadvertent exposure of personnel is required. The presence of these barriers must make it extremely difficult for an unauthorized person to gain access to areas where radiation or contamination levels exceed those specified in chapter 2. To prevent inadvertent exposure, radiation areas above 5 mR/hr, such as near the activated primary system of a power plant, must be appropriately marked and should not be accessible except by cutting of welded closures or by disassembling and removing substantial structures and shielding material. Means such as a remotely monitored intrusion detection systems must be provided to indicate to designated personnel that a physical barrier has been penetrated. Security personnel who control access to a facility may supplement or be substituted for the physical barriers and the intrusion alarm systems.

b. Inspections and Surveys. The decommissioning plan shall identify all inspection and survey requirements and establish a schedule for these activities. At the very least, the following are required:

(1) Physical barriers and the facility structure should be inspected at least quarterly. This is to assure that these barriers have not deteriorated, that locks and locking apparatus are intact, and unauthorized entry has not occurred.

(2) A facility radiation survey should be performed at least quarterly to verify that no radioactive material is escaping or being transported through the containment barriers in the facility. Sampling should be done along the most probable path by which radioactive material such as that stored in the inner containment regions could be transported to the outer regions of the facility and ultimately to the environment.

(3) An environmental radiation survey should be performed at least semiannually to verify that no significant amounts of radiation have been released into the environment from the facility. Samples such as soil, vegetation, and water should be taken at locations for which statistical data have been established during reactor operations.

(4) Inspect the facility for signs of damage or weathering.

c. Administrative Controls. The decommissioning plan shall establish administrative controls and identify responsibilities of personnel related to managing, monitoring, and securing deferred decommissioned facilities At the very least, the following are required:

(1) A site representative must be designated to be responsible for controlling access into and movement within the facility.

(2) Responsibilities for performing inspections, radiation surveys and record keeping must be established.

(3) Administrative procedures must be established for the notification and reporting of abnormal occurrences such as the entrance of an unauthorized person or persons into the facility, a significant change in the radiation or contamination levels in the facility or the off-site environment.

(4) Responsibility for maintenance of the facility for the repair of damage due to weather, aging, or other factors along with maintenance of electrical, mechanical, and fire protection systems which will be used in support of the final decommissioning.

d. Guidance Documents. Limited guidance on preparation of facilities for deferred decommissioning of facilities along with control and surveillance requirements of such facilities is given in Regulatory Guide 1.86. Guidance on providing LLW interim storage is given in SECY-81-383; NUREG-0800, Appendix 11.4-A; and USNRC Generic Letter 81-38. These sources should be reviewed when preparing decommissioning plans.